

**From:** [Robert Neely](#)  
**To:** [Peter.Knight](#); [Eric Blischke/R10/USEPA/US@EPA](#); [Chip Humphrey/R10/USEPA/US@EPA](#)  
**Cc:** [Alyce Fritz](#); [Mary Baker](#)  
**Subject:** Re: [Fwd: Fw: [SBRP-brief] Research Brief 184: Linking Site Specific Contaminant Mixtures to Biological Responses]  
**Date:** 04/09/2010 11:45 AM  
**Attachments:** [robert\\_neely.vcf](#)

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Hey Peter,

This is the first of heard of it. I'm copying Chip and Eric, the RPMs.

Chip and Eric -- do you guys anticipate that this work will feed into the decision process for the site? If so, how?

Curious to hear your thoughts on the topic. FYI, Peter is one of my counterparts in Region 3 and Alyce is NOAA's Northeast Branch Chief.

Thanks,

R

Peter.Knight wrote:

> Alyce and Rob, Are either of you familiar with this technique for  
> measuring toxicity. Can you offer any helpful hints? The site Josh is  
> talking about is the Lower Darby Creek Area (LDCA), which at the  
> moment looks like impacts from the two landfills (Folcroft and  
> Clearview) may be hard to separate from the background concentration  
> levels that are arriving in the tidal portion of Darby Creek via the  
> creek and the industrial areas (including a tank farm, former  
> incinerator, etc) in the vicinity of Folcroft Landfill (part of the  
> John Heinz National Wildlife Refuge). I am not sure this additional  
> way of measuring toxicity will in any way uncomplicate an already  
> complicated Superfund Site (from both a geographical standpoint as  
> well as the problems the EPA contractors have caused). Anyway, any  
> help would be appreciated. Thanks, Peter

> ----- Original Message -----  
> Subject: Fw: [SBRP-brief] Research Brief 184: Linking Site Specific  
> Contaminant Mixtures to Biological Responses  
> Date: Wed, 07 Apr 2010 15:34:44 -0400  
> From: Barber.Joshua@epamail.epa.gov  
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> Simeon.Hahn@noaa.gov  
> CC: ApakianMJ@cdm.com

> You guys ever heard of this?

> Any potential application to Folcroft?

> Josh

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> ----- Forwarded by Joshua Barber/R3/USEPA/US on 04/07/2010 03:32 PM -----  
> From: Maureen Avakian <avakian@niehs.nih.gov>  
> To: sbrp-brief@list.niehs.nih.gov  
> Date: 04/07/2010 03:23 PM  
> Subject: [SBRP-brief] Research Brief 184: Linking Site Specific  
> Contaminant Mixtures to Biological Responses

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>  
> SRP Research Brief  
> \*Research Brief 184:  
> Linking Site Specific Contaminant Mixtures to Biological Responses\*  
> \*Background:\* Understanding environmental exposures and accurately  
> predicting their impact on human and aquatic ecosystem health requires  
> innovative, interdisciplinary approaches. Quantifying exposure is  
> complicated. For example, measures of "total" ambient contaminant  
> concentrations may represent only a rough estimate of potential  
> exposures-in part because such analyses measure only specifically

> defined contaminants of interest. In addition, concentration  
> measurements may not accurately reflect the bioavailable fraction of  
> contaminants, or take into account the synergistic or agonistic  
> interactions of compounds in a contaminant mixture.

>  
> Dr. Kim Anderson at the Oregon State University SRP is working to  
> refine and combine two technologies to assess the toxicity of  
> bioavailable contaminant mixtures present in the environment. Building  
> upon lab work and field trials conducted at a Superfund Megasite in  
> the lower Willamette River (Portland, OR), her research team created a  
> bio-analytical tool that  
> SRP Research Briefcan assess multiple biological responses to  
> environmentally relevant mixtures in a whole organism vertebrate model.

>  
> \*Advances:\* Dr. Anderson's \*biological \*response \*indicator  
> \*devices for \*gauging \*environmental \*stressors (BRIDGES) uses  
> passive sampling devices plus an embryonic zebrafish developmental model.

>  
> /Passive sampling devices (PSDs):/ Basically, PSDs are low density  
> polyethylene tubing used as /in situ/ samplers. They mimic key  
> mechanisms of bioconcentration and interact only with the dissolved  
> fraction of the contaminant, allowing researchers to focus on  
> bioavailability and activity, rather than on the mere presence of  
> chemicals. PSDs also have size-discrimination capabilities similar to  
> cell membranes so contaminants too large to penetrate gills or other  
> epithelium cannot pass through the PSD membrane. While passive  
> sampling devices generally contain a small volume of lipid, such as  
> triolein, Dr. Anderson's team demonstrated that lipid-free tubing  
> (LFT) are both reliable and cost-effective. They developed extraction  
> methods for LFTs that reduce labor, eliminate chlorinated solvents,  
> and reduce overall solvent use while improving recovery of target  
> analytes. LFT extracts have been used extensively for chemical  
> analysis and more recently in bioassays that assess toxicity.

>  
> /Embryonic zebrafish model:/ Dr. Anderson's group collaborated with  
> Dr. Tanguay's Aquatic Biomedical Models Facility Core to expose  
> embryonic zebrafish to LFT extract in order to assess the toxicity of  
> environmentally relevant contaminant mixtures. Embryonic zebrafish are  
> an ideal model for full organism bioassays and are widely used to  
> investigate developmental toxicity. Zebrafish have many advantages  
> over other vertebrate bioassay models with respect to their size,  
> husbandry and early morphology. Furthermore, the embryos are nearly  
> transparent, allowing for clear non-invasive visualization of internal  
> organs.

>  
> /Application of BRIDGES to Portland Harbor Superfund Megasite:/ To  
> evaluate whether the BRIDGES tool can effectively link site-specific  
> bioavailable contaminant mixtures to multiple biological responses,  
> the researchers deployed LFT PSDs for 21 days at five locations within  
> and outside of the Portland Harbor Superfund Megasite. They exposed  
> zebrafish embryos to LFT extracts at approximately 6 hours post  
> fertilization (hpf) and scored the developmental impacts at 30 and 126  
> hpf.

>  
> Dr. Anderson's research team modified an embryonic zebrafish metric  
> (EZM) developed to assess nanomaterial toxicity. They determined a  
> score (or metric) for each embryo by evaluating 18 endpoints including  
> mortality and the presence or absence of morphologic malformations  
> including deformations of the heart, yolk sac, tail, and notochord.  
> The EZM integrates multiple biological responses into a single,  
> non-specific overview of general toxicity that facilitates general  
> comparisons between treatment groups. The EZM scores were highest for  
> embryos exposed to extracts from sampling sites within the Superfund  
> Megasite and an exposure concentration-response was observed for LFT  
> extracts from those sites.

>  
> Dr. Anderson's team found that additional analysis of individual  
> endpoints provides different insights into site specific toxicity than  
> EZM alone. The researchers found that both the type and frequency of  
> toxic endpoints observed were significantly different between sites.  
> For example:

>  
> \* Mortality was so high for embryos exposed to extracts from  
> sampling site RM 3.5 E (see map) within the Superfund Megasite  
> that data on sublethal developmental effects could not be  
> collected.

>  
> \* Notochord waviness was observed only in embryos exposed to  
> extracts from the sampling site RM 7W (within the Superfund  
> Megasite, see map) whereas significantly higher incidence of  
> underdeveloped bodies was only observed for RM 7E on the  
> opposite bank of the river. These significant differences in  
> toxicity show an association with differences in the  
> concentrations of PAHs, PCBs, organochlorine pesticides and  
> other chemicals of concern detected at these two sites.

>  
> These results demonstrate the sensitivity of this rapid throughput,  
> full organism vertebrate model for detecting distinct toxicity in  
> aquatic systems even between sampling sites within close proximity.

>  
> SRP Research Brief

>  
> \*Significance:\* Many biological exposure studies are not conducted at  
> environmentally relevant concentrations and/or are not performed with  
> realistic mixtures typical of contaminated sites. This limits their  
> applicability to address important human and environmental health  
> questions related to real-world exposure scenarios and biological  
> responses. Dr. Anderson's work demonstrates the effectiveness the  
> BRIDGES bio-analytical tool to link bioavailable contaminant  
> concentrations to biological responses, providing an interface between  
> environmental exposure and aquatic/human health risk.

>

> Dr. Anderson believes the BRIDGES bio-analytical tool could be used as  
> a complementary tool for environmental and risk assessment in  
> conjunction with chemical characterization of sites. BRIDGES could  
> inform management actions by providing site-specific mixture toxicity  
> data that could be used to validate management actions or suggest  
> further investigate or reassessment.

>  
> \*For more information, contact:\*

> Kim Anderson, Ph.D.  
> Oregon State University  
> Department of Environmental and Molecular Toxicology  
> 1127 Ag Life Sciences Building  
> Corvallis, OR 97331  
> 541-737-8501  
> Email: kim.anderson@oregonstate.edu <mailto:kim.anderson@oregonstate.edu>

>  
> \*To learn more about this project, please refer to the following source:\*

> Wendy E. Hillwalker, Sarah E. Allan, Robert L. Tanguay, Kim A.  
> Anderson. 2010. Exploiting lipid-free tubing passive samplers and  
> embryonic zebrafish to link site specific contaminant mixtures to  
> biological responses. /Chemosphere/ 79 (2010): 1-7.  
> Available online: DOI:10.1016/j.chemosphere.2010.02.001  
> <[http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6V74-4YF5TTD-5&\\_user=10&\\_coverDate=03%2F31%2F2010&\\_rdoc=1&\\_fmt=high&\\_orig=search&\\_sort=d&\\_docanchor=&view=c&\\_searchS](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V74-4YF5TTD-5&_user=10&_coverDate=03%2F31%2F2010&_rdoc=1&_fmt=high&_orig=search&_sort=d&_docanchor=&view=c&_searchS)>

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>  
> To learn more about the Superfund Research Program, visit the SRP web  
> site <<http://www.niehs.nih.gov/research/supported/srp/index.cfm>>.

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